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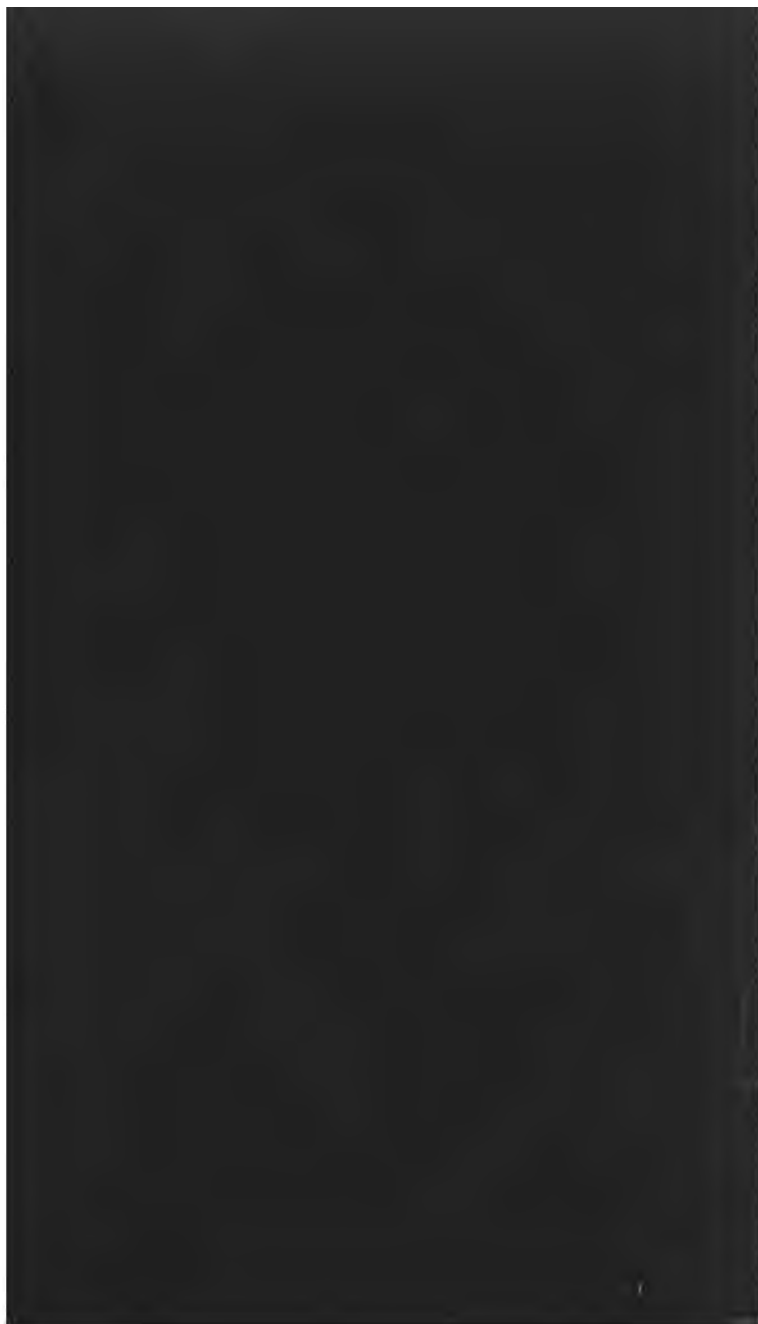
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From the
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. LINK BETWEEN DIVINE INTELLIGENCE AND HUMAN.

AN ARGUMENT.

BY

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SECOND EDITION.

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Les "Mathématiques pures", où
tout va dans l'ordre, et où il
a moyen de les dé mêler, par
une méditation exacte, qui ne
fait qu'un, pour ainsi dire, de
vue des idées de Dieu".
Leibniz. 577 b.

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PREFATORY NOTE.

A PHILOSOPHY of materialism, and a religion in which material sense predominates over spiritual, are at present loudly boasting of the many proselytes each has gained amongst persons not without considerable pretensions to culture, whether philosophic or religious. It may therefore prove not unseasonable, if one born in the preceding century, who has long been deeply interested in the researches of modern Science, now offers for consideration the following argument; tending as it does to prove, on grounds of reason generally intelligible, rather than technically scientific, the essential spirituality of human nature. For the more thoroughly man can be convinced, not only that God is a Spirit, but moreover that he himself, though he has a material body, yet in respect of his higher faculties is a spirit akin to his Creator, the better will he be prepared to reject those materialistic notions, which would hinder him as a philosopher from believing in the true God, and as a believer from worshipping that God in spirit and in truth.

Weston-super-Mare, January 1, 1875.

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NUMBER.

§ 1.—*Number and its properties are invariable.*

AMONGST the flights of modern speculation, it has been suggested, that there may possibly be in the universe regions and minds in which two and two make five instead of four, and in which three and four multiplied together produce a sum other than twelve. This idea, however amusing as a stretch of imagination, would indicate, if seriously entertained, a very defective notion of the nature of Number in itself, and of the important place which its properties occupy in the constitution of the material World. But whatever this vague speculation may be worth, it would not invalidate the striking testimony which Number, as generally understood, may be shewn to give to the statement, that man is made in the likeness of his Maker, instead of having been, as surmised by some, developed from the lower orders of creation. It is to the bearing of Number on this question of man's lineage, as pointing to an origin for the human race not below human

nature but above it, that the following argument will chiefly direct attention ; pursuing throughout one definite train of reasoning, which it is believed has not been elsewhere so distinctly set forth. And inasmuch as it rests mainly on grounds which underlie the foundations of modern Science, in most if not in all of its departments, it may perhaps have some little weight with those who follow after knowledge scientifically, out of a pure desire to discover and hold fast that which is true.

There are many to whom man's moral sense seems the most manifest link between the human race and its divine Author. But it is on the intellectual sympathy between the two, in regard to Number, that the following argument is based ; being addressed to those who hold that certainty is by no means so attainable in subjects of a moral nature, as in those which are purely scientific. Now it will be admitted by all such, that Weight and Measure are amongst the chief means of scientific investigation, and chief tests of certainty in scientific conclusions. And Number is the means of expressing weight and measure ; so that without it, and unless its properties were invariable, the whole fabric of modern Science would collapse. Number may be regarded as Quantity exactly limited ; whether it be absolute or relative. Used absolutely Number is the quantity of individual objects, whether persons or things, distances, surfaces, or solids, each thought of as actually sepa-

rated, or as separate portions of one whole. Used relatively Number indicates the proportion between two or more of any such objects. Thus Number denotes quantity with precision ; substituting clear and definite ideas for the vague notions suggested by the terms large and small, many and few, much and little. There is an art of Number ; and a science of Number. The art is taught in our common treatises of arithmetic. However much these may vary in the details of their subject, they invariably agree in their conclusions. For the science of Number the reader is referred to such treatises as Leslie's 'Philosophy of Arithmetic,' and Sandeman's 'Peficotetics.' Herein also it will be found, that the nature of Number and of its properties, whether considered absolutely or relatively, are held to be uniformly invariable. Number may be denoted by letters or by figures. It may be arranged on different scales, as the denary or the duodenary. But variations of this kind do not affect the solution of any problem in addition or subtraction, in multiplication or division ; to which processes all the most intricate calculations are reducible. The principles on which all problems of Number are solved are as fixed as those of pure mathematics. Of this latter science Number may be regarded as a branch ; if it be not rather its root and its foundation. In support of this claim on the part of Number to the highest rank, it may be urged, that nearly all of the

twelve axioms usually prefixed to Euclid are more or less numerical.

§ 2.—*The numerical law of gravitation.*

Amongst the physical sciences there are none in which the mind of man has achieved triumphs more remarkable, and established them on grounds more incontrovertible, than in Astronomy and Chemistry. It is from these two that it is proposed to derive the chief illustrations of our argument; beginning with astronomy. And herein attention will be first directed to the law of gravitation as laid down by Newton, and afterwards to Kepler's laws of planetary motion. These are matters within the cognizance of all who know ever so little of popular astronomy; they are conclusions about which there can be no doubt in any mind which has once mastered their significance and proofs. Now these laws obviously involve certain numerical proportions, which cannot but have been present in the Mind which planned the Universe, supposing it was ever planned by any mind at all; which proportions are also clearly intelligible to the mind of man, who alone, amongst all creatures known to us, seems to have the faculty of comprehending them.

A few words express the numerical law of gravitation; namely, that every portion of matter gravitates towards every other portion, with a force varying directly as the amounts of their respective

masses, and inversely as the squares of their distances from each other. The first clause of this law presents no difficulty. We readily acquiesce in the notion that bodies attract each other with forces proportioned to their masses. And many would be inclined to suppose, that in like manner the force of attraction or gravitation would decrease just in proportion as the distance is increased. But in point of fact the decrease of the force is proportioned to the square of the Number expressing the distance. At twice the distance the force is not twice less but four times less, the number four being the square of the number two. And in like manner at thrice the distance the force is nine times less, and at ten times the distance it is a hundred times less. Nor would it be any exception to this law, properly understood, if it could be proved quite as clearly, that the ultimate atoms of which matter consists are connected with each other by a law of attraction somewhat different. For, not to urge the probability that this law, be it what it may, would involve considerations of Number, it is obvious that these atoms are all constituent parts of the masses, whether great or small, to which the numerical law of gravitation is applicable universally.

§ 3.—*The universality of this law indicates one Lawgiver.*

It is to be observed then, that this varying of gravitation, in numerical proportion, inversely as

the square of the distance, is the rule with all masses of matter, whether great or small, whether heavy or light ; and at all distances, whether from the moon's orbit to the centre of the earth, or from the bough of a fruit tree to the ground. And this law holds good, not only of any two bodies as isolated from others, but of all bodies acting on each other, at all distances, and in all directions. Now there are experts in Science, of no small eminence, who seem to think, that the universal prevalence of this one numerical law is no presumption of its having been devised and ordered by the intelligence and will of one Lawgiver. Rather they are disposed to argue from the reign of law in nature, that the sovereignty of a lawgiver may be dispensed with ; and that the matter of which the universe consists may have imposed this law upon itself. This they admit to be mere theory, unsupported by scientific demonstration. Which theory of the two is most entitled to acceptance they account a question of uncertain probability.

The case stands thus : Here is a Law involving certain properties of Number, controlling all the matter with which man finds himself surrounded ; in conformity to which law planets are retained in their orbits, birds poise themselves in the air, ships float upon the water, and man himself, together with all the structures of his contrivance, is enabled to retain his footing in repose, whilst

the globe on which he stands firm and upright is incessantly undergoing at the least two revolutions of exceeding swiftness. Now what conclusion can commend itself more forcibly to man's reason, than that the universal action of this one law, itself in every case the expression of a definite numerical proportion, proves it to be the edict of one intelligent Lawgiver, acting on principles intelligible to man himself?

§ 4.—*The faculty of Number belongs to man and not to brutes.*

That the world must be the work of an intelligent Creator, is a conclusion which has been held for certain by thinkers of the highest order in the domain of Science; as will be admitted by those who now think otherwise. Moreover this is a conviction which has impressed itself on the common sense of nearly all amongst the multitudes who have thought at all upon the subject. But whether the proposition thus generally accepted be one of axiomatic certainty, or of probability more or less conclusive, it may be safely asserted, that the law of numerical proportion between the gravitation of bodies and their distances from each other, prevailing throughout all space, and affecting all the contents of space within man's cognizance, is not only intelligible to the human mind, but has been actually discovered, and scientifically demonstrated by human sagacity. Whence then has man derived

his power of apprehending it? Do we meet with the like capacity elsewhere? Do the planets obey this law intelligently? Are the rocks aware that by this law they are held fast? the tides that it is this which sways their waters to and fro? Can those who derive man's lineage from the brute creation point out to us a bird or quadruped which can intelligently calculate numbers and their squares, or can comprehend, much less solve such problems as were familiar to Euler, and to Babbage? It is admitted that animals, wild as well as domesticated, shew traces of affection, of association, and of memory; besides a wilfulness which faintly resembles that most wonderful of all the gifts bestowed on man, the power of originating independent action, yet subordinate and consciously accountable to the Will from which it has been derived. But that no like traces of a faculty to apprehend relations of Number, or to perform the various operations of arithmetic, have been met with in bird or beast, is a proposition which may be confidently maintained.

Leaving then man's moral nature out of sight, and having in view only his intellectual faculties, it is maintained, that in this one of them, the capacity to calculate Number, and to apprehend its intimate connexion with a law impressed on all things, there is manifested an impassable gulf between man and all other creatures in man's cognizance; and that there is manifested also a

closely connecting link between man's mind and the supposed Intelligence by which all things have been ordered. Whether we contemplate a Newton generalising the phenomena of gravitation, or a Somerville deeply interested in a treatise on quaternions at the close of her protracted life, or a child studying the elementary problems of Euclid, algebra, and arithmetic, we can hardly fail to discern traces of a lineage quite alien to that of the brute creation, and akin rather to that super-human thinking Power to which the universe owes its orderly and harmonious working, always and everywhere alike.

§ 5.—*The numerical laws of planetary motion.*

The laws of planetary motion, approximately announced by Kepler, and demonstrated by Newton in mathematical connexion with the law of gravitation, form the next illustration of this argument to which attention is to be directed. Considerations of Number are involved in all three of these laws, but more particularly in the third. Up to Kepler's time it had been generally supposed that the planets move in circular orbits. But observations on the planet Mars led this great thinker to conjecture, that it moved in an ellipse, or oval; an elongated circle around two points, each of which is termed a focus, in one of which the Sun occupies a central position; and this not only in regard to

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Mars, but, as it soon became evident, in regard to all the planets. The properties of the ellipse had been previously demonstrated by the Grecian geometers. And by combining this knowledge with Tycho Brahe's observations, Kepler was enabled to lay down his first law, namely, that all the planets revolve in elliptical orbits, having the sun in one of the foci of each ellipse. His second law is closely connected with the first. He was led to conjecture that the orbit of Mars was not circular but elliptical, by having observed, that in different parts of its orbit it moved at different rates. He next found that the increase or decrease of its rate of motion might be measured, supposing the orbit to be an ellipse, by marking off on that curve the spaces passed over in equal times, and drawing lines to the points thus marked from the sun supposed to be in one focus. Each line so drawn is called a radius vector. And each planet moves just so much faster when drawing nearer to the sun, and slower when receding from it, as to cause the radius vector to describe equal areas on the supposed surface of the ellipse in equal times. This is Kepler's second law of planetary motion. In his third law Kepler defined the proportion which he found to subsist between the length of time which it takes each planet, as compared with any other, to complete its yearly orbit, and the mean distance of each from the common focus of attraction, or centre of gravity, in the sun. This law he expressed thus : The

THE END

squares of the periodic times vary as the cubes of the distances. This proportion, though not inverse like that which obtains in the law of gravitation, is somewhat more difficult to follow out; involving processes of arithmetic more perplexing to the unpractised mind. And until these processes are mastered, this law gives no very definite conception; except that obviously the proportion of the periodic times does not increase as rapidly as that of the distances; or, in other words, that the planets, at greater distances, move in their orbits less swiftly than would be the case if at double the distance they occupied no more than double the time.

But these problems of Number, however intricate they may seem to many, are simplicity itself compared with others which need to be solved at almost every step in the researches of astronomy; one reason being this, that the courses of planets and satellites are so largely affected by their incessant action on each other, as to become in fact very different from the regular orbits suggested by Kepler's laws. So much the more, however, does this profound science illustrate the present argument; shewing the extent to which the properties and processes of Number, whether intricate or otherwise, are at once in harmony with man's mind when adequately cultivated, and interwoven in laws which pervade all space. Indeed it is not wholly improbable, that the operation of these

laws, and the corresponding relations which subsist between each number and its square and cube, are connected, in the nature of things, with those three dimensions, the linear, the superficial, and the solid, which are inseparable from our ideas of Space itself.

§ 6.—*The universal application of these laws.*

The three laws announced by Kepler, like the law of gravitation demonstrated by Newton from which they flow, are applicable not only to the orbit of each planet, but to that also of each satellite, of each comet, and of the sun itself; and indeed also to other suns connected with each other thereby. It is to results calculated on the basis of these laws that we owe the recent discovery of the planet Neptune; a most remarkable illustration of their prevalence, and of the presence and predominance of numerical proportion in regions which can be scanned only by the telescope. That great triumph of human intelligence, verifying most signally the sagacity of man in conjecturing, and his accuracy in computing, could never have been achieved, if it were not that Number and its properties are invariably the same, alike in divine astronomy and in human, in the Mind by which the worlds were planned, and in that which investigates their structure and connexion.

It is to be borne in mind, that the planet Uranus had for some years been considered the most

remote from the sun, out of all that constitute the solar system. But although there had not been time, since its discovery, for it to complete the long period of its orbit, enough had been observed to indicate, that its pathway through the heavens did not exactly coincide with that which it ought to take, according to the accepted doctrines of Kepler and Newton. Hence arose the conjecture that it might be affected in its course by some hitherto undiscovered planet, further from the sun than itself, and accounting for a variation in its orbit otherwise inexplicable. Every planet is liable to many disturbances in its course, owing to the fact, that every orb gravitates towards every other; each running its career at different distances from the sun, in different periodic times, and at different angles of inclination. But all these disturbances, numerous and ever varying as they are, admit of approximate calculation. Hence it proved possible so to take into account the effect of all these forces acting upon Uranus, as not only to verify the conjecture that there must be a planet still more remote, but also to announce the place which it was occupying at the time in the heavens; and in which it was actually seen pursuing its course, by those who pointed the telescope in the precise direction thus indicated by calculation.

§ 7.—*Astronomical forecasts confirmed by experience*

Probably nothing tends so greatly to establish general confidence in the calculations and conclusions of astronomers, as the many instances, not indeed all so striking as the case of Neptune, but more obvious and familiar, in which observation and experience are continually corroborating their statements in regard to things about to happen. Such instances are the occurrence of eclipses at the very moment of time announced; their being partial, total, or annular; and their being visible only in certain limited localities. Such are also the reappearances of comets in periodic times, much disturbed in their courses as their slight masses are by more ponderous planets. Such are also the daily-recurring tides, and exceptionally high tidal waves; which result, and may be surely prognosticated, from the relative position of the sun, earth, and moon, and of other planets in conjunction or opposition, however varied by their respective movements and rotations. One of the most notable of such instances is the not uncommon occurrence of a successful voyage to the antipodes, occupying it may be three months or more; during which time the navigator, without once sighting land, knows at every hour whereabouts he is, and is aware, though it should happen in the dark of midnight, that he is draw-

ing nigh to the coast for which he is bound, and which he finds in sight at the dawn of day. In all this, besides his compass, and log, and observations, he is largely aided by a nautical almanack, prepared expressly for this purpose, and embodying the results of the most abstruse astronomical calculations, on which he justly places implicit reliance.

Thus does Science, with Number for its master-key, unlock the secrets of planetary space, and render them subservient to man's uses on the earth. Thus without the aid of fluxions, and logarithms, and the calculus, all then unknown, was Kepler enabled, by his indefatigable computations, and sagacious conjectures, to announce numerical laws, on which, as confirmed by Newton's subsequent discovery, and profound mathematical demonstrations, the whole Science of modern Astronomy has been constructed. Owing to his announcement of these laws, Kepler was entitled the Legislator of the Skies; as if the planets moved in orbits not merely discovered but actually assigned to them by man; so uniform is the coincidence between human thought concerning them, and the dictates of that higher Thought of which man is only the interpreter. But Kepler well knew and was ever forward to acknowledge Who it is, to whom alone any such a title appertains. Kepler was one of those to whose apprehension 'the heavens declare the glory of God.' And it is noteworthy in connexion with our main

argument, that occupied, as he was for seventeen long years, in attempting to discover and verify the third of his laws, his calculations often baffled by vexatious failure, he was constantly sustained by the conviction, that there must be some proportion of Number between the times and distances of the planets throughout the solar system. For which conviction he reverently gave this reason: 'because God, who made the world, had established throughout all his works fixed laws, and these often so definite as to admit of expression in numerical terms.'

§ 8.—*The numerical law of chemical combination.*

Turning attention next to chemical science, we might almost deem the above words of the great astronomer prophetic of the grand discovery in modern Chemistry, ever associated with the name of Dalton, the law of chemical combination in definite proportions. Chemistry, like Astronomy, treats of no less than all the matter in the universe, so far as observation can extend; Astronomy dealing with matter chiefly in huge masses; Chemistry scrutinising it in its most minute particles; but both finding their laws closely bound up with the properties of Number. And although the results are less widely known, even after a popular fashion, in the case of chemistry than in that of the other and much

longer established science, it is important to explain their bearing on our argument, to the apprehension of the general reader ; inasmuch as he cannot fail to be often meeting with arguments to the contrary, as if man not only had no link of likeness to his Maker, but probably may never have had any Maker at all.

Now it is the business of the scientific chemist to examine every substance within his cognizance, whether it be solid, or liquid, or gaseous ;—to analyse it, and to test it ;—to weigh it, or to measure it ;—with a view to ascertain the nature of each, and the mode in which these substances, whether separate or combined, affect each other's qualities and condition. Most substances prove to be composite, made up of two or more ingredients, which when chemically united seem to merge their own properties in those of the substance which they constitute. To separate these ingredients, however closely thus combined, to resolve these composite substances into such as admit of no further like separation, and are therefore reckoned elementary, is one chief object of chemical science. Connected therewith is the endeavour to ascertain how the elements thus shewn to be separable are actually combined by nature, and how they may possibly be combined by human art. Rather more than sixty such elements are at present recognized by Science, as forming the materials of which all things animal, vegetable, and mineral consist, of all land and water, of our whole globe with its

atmosphere, and also partly, if not wholly, of all other orbs within reach of our scrutiny. The combinations of which these various elements admit are very numerous. And it was of the utmost importance to ascertain whether there were any law regulating these chemical unions, and applicable to all these chemical elements. It has been proved that there is such an universal law, and that it is essentially a law of Number.

The law may be stated thus : No element combines chemically with any other, except in definite and invariable proportions, measured by weight or volume. And the proportion in which each element combines with others is expressed by a distinctive number, appropriate to each ; which number, or some multiple thereof, expresses the exact share which it contributes, neither more nor less, in the formation of composite substances. Thus the number of oxygen is 16, of carbon 12, of iron 56. And these numbers are so absolutely to be relied upon, that in chemical treatises the capital letter O stands by way of brevity, not for oxygen merely, but for 16 parts of oxygen. And multiples of these numbers, which often occur in combination, as twice 16 parts, or thrice, are sufficiently indicated to the chemist by the formula O_2 or O_3 . Except in the proportions indicated by their respective numbers no elements are found chemically combined in natural substances, nor can any be combined otherwise by man's art. On attempting to do so with

any element, there always remain over, uncombined, just so many parts of it as are in excess of its distinctive number.

It must be remembered, that the union here spoken of, as chemical combination, is not such as results from the mere mechanical admixture of various ingredients, as of tea with milk, or of wine with water. These may be stirred together in any proportion we think fit; each retaining its own properties notwithstanding, and the mixture being strong of the one or of the other according to the proportion of each made use of. In chemical union, on the contrary, the elements upon being combined assume quite a new character, and manifest quite different properties. Water, for instance, which consists of oxygen and hydrogen in chemical combination, bears no resemblance to either of its elements. Moreover, each of these admits of union with many others, the resulting substances being distinct in character and properties from each other and from their elementary constituents. Thus it is that out of a few simple rudiments the whole world of matter is built up, with all its varied contents, organic and inorganic, on principles wherein Number is everywhere predominant.

§ 9.—*Illustrations of this argument from other sources.*

The presence and influence of Number throughout the universe might be further illus-

trated from other sciences relating to inorganic matter; as, for instance, from those of Light and of Sound, which disclose to us the exact number of vibrations, in a given time, to which we owe each colour in the rainbow, and each note in the scale of harmony; rendering it probable, that the impressions made on the senses of touch, taste, and smell are also conformable to a numerical scale. Crystallization bears like testimony to the reign of Number, as by the angles distinctive of each crystal, and by Snell's numerical law of the refraction of light by each crystal distinctively. It has been shewn by recent discovery, that such Forces as Heat and Gravitation are correlated to each other numerically: the gravitating force of a certain weight, falling a certain distance, proving exactly equal to, and convertible into, a corresponding measurable amount of heat. Spectrum Analysis also, a recent and most promising branch of Science, rests largely on a numerical foundation; the intensely heated atoms of different elementary substances originating light vibrations at different rates, whereby the substances are distinguished from each other. Moreover, this new science tends to prove the identity of many chemical elements existing in the heavenly bodies with those which are met with here on earth. And hence it is obviously presumable, that the numerical law of definite proportion extends throughout the realms of space, in regard to each least particle of matter,

no less widely than the dominion of Number prevails in keeping the largest masses in their places.

Organic matter is regulated by Number no less than inorganic. Every department of Natural History is full of symmetry. Botany numbers the pistils and stamens of each blossom, and shews that leaves are arranged with geometrical precision. The feathers in the wings and tails of birds are numbered so exactly, that in above four hundred species of humming birds these numbers are invariably the same. Passing from organic matter to the perception of Beauty, or *Æsthetics*, we find evidence, in the writings for instance of Mr. Vane and of Dr. J. A. Symonds, that the effect which we call Beauty—in Painting, Statuary, and Architecture, not less than in Music—depends strictly on the arrangement of the elements of the composition in certain ascertainable mathematical proportions. Nay more, Professor Bain, in his treatise on Logical Induction, has referred to ‘a hope of attaining quantitative accuracy in the science of mind’ (p. 288). However this may be, and whether or no the faculties of the spirit that is in man admit of being denoted by a numerical scale, we know that the elements of his material body, like those of other animated beings, are conformable both to the chemical and to the astronomical laws of Number.

It has already been observed that man stands alone in the known creation in apprehending

Number. In that conscious intelligent self, which each man feels that he truly is, he readily apprehends, and has actually ascertained, by discovery and proof, the modes in which Number has been made use of in the ordering of the universe. And moreover, he is able to make use of Number largely himself, in those countless mechanical devices and constructions, in which he takes a sort of creative interest; faint copyings of that creation by mere volition, to which all things, including man himself, owe their being, as generally believed. Such works of man are his pyramids, temples, and palaces, his bridges, and aqueducts, his ships, steam-engines, and chronometers; some of them inert, some endowed by human skill with life-like motion; but all limited by the materials and forces at his disposal, and, like his own continuance in the present life, incapable of becoming perpetual. In all these productions of man's art Number ministers to man's uses, and to his enjoyment; as it does also in statues, in pictures, and in poems; the most remarkable of the creations, as we call them, of man's genius.

It is indeed a notable instance of the use of Number in creation, that man is gifted with the power of using it for his own purposes; and this not only in his constructive works, but also in the various doings and details of his life, civil, social, and domestic. It is by Number that he marks his hours, days, and years; that he keeps accounts, buys and sells, and carries on commerce in all

quarters of the globe. National finance, banking, insurances, joint stock enterprize, all depend on man's calculations of Number. So does also the census of population, and so do all statistics, as those of health and sickness, of longevity and mortality. We are measured for the clothes we wear, we regulate by Number our food and our medicine, and the intervals of time at which we take them. By Number we tabulate the depth of ocean, the height of mountains, the length of rivers, the miles of each journey, the leagues of each voyage. By help of this same ever serviceable instrument we are enabled to date in order the facts of our histories, and to refer to the multitudinous volumes in our libraries, as well as to the contents and pages of each. By the same means we indicate the chapters and verses in our Bible. Whether we scan the pages of that sacred book, or glance over the columns of our daily journal, that mirror of man's life, replete with Number as it is throughout, we might do well to ask ourselves such questions as the following : How came I by this unique faculty of numeration ; so observable in all the realms of nature, so conformable to my own will in all my works and doings ? Is it of spontaneous growth in my own brain ? Or can I have got it by descent from creatures who had none of it, under circumstances favourable to its development ? Is it not infinitely more probable, that it came to me by heritage from a Being so familiar with its use, alike in things great and small, that He telleth the

Number of the stars, and by Him even the very hairs of my head are all numbered? Or if on looking at the things seen, and pondering on their significance, we knew no better than like the Greeks of old to build our altar to 'The Unknown God,' yet our discernment of Number, invisible though it be, pervading all his workmanship, and regulating all our doings also, would constrain us to adopt the statement made by certain of the same favoured race, that 'we are his offspring.'

§ 10.—*Objections to this argument stated and answered.*

The conviction to which these considerations lead is one of deep solemnity. Man may well stand in awe, when he recognizes, in the constitution of his own nature, a capacity for entering into ideas which permeate the fabric of the Universe, and which therefore must be ever present to the intelligence of that supreme Being who, according to the belief generally prevalent, made and upholds all things. But some of those to whom this argument is addressed harbour doubts as to the existence of any such divine Personality at all. And they may probably object to its validity on the ground, that it does not admit of the only evidence they rely upon. They say that we know nothing with certainty beyond what our senses tell us. But since sight without thought would not teach us that the earth revolves daily on its axis, but rather

the reverse, they admit that we may call in the aid of thought mathematical, and of demonstration scientific, as means, but the only other means, of obtaining certainty. This opinion, if correct, would place certainty, on very many important subjects, wholly out of the reach of most men. If it were thus with us, who could venture to feel sure, without crossing the Atlantic, that there is such a continent as America? General notoriety, and the impartial testimony of our fellow creatures, can give us a sense of perfect certainty. So can also analogy; so can circumstantial evidence; so can other proofs within the province of Probability; which has a logic of its own, commonly but somewhat vaguely termed Moral Evidence. This Logic of Probability, if applied under its own proper laws of reasoning, is capable of impressing the human mind with convictions quite as firm, and as reliable, as those which result from pure mathematics, though based on proofs of a different kind. And in reply to the above objection it is enough to say, using the words of 'Gambier on Moral Evidence,' that 'when there is produced in favour of any proposition the highest kind of evidence of which it admits, and in a sufficient degree to outweigh all that can be said against it, it may be properly said to be proved' (p. 17).

But further it may be objected, that traces of a sense of Number are to be met with in the works of creatures far inferior to man; as in the spider's web,

and in the geometrical cell of the bee. The latter singular phenomenon is possibly to be accounted for by the existence of an hexagonal lens in the bee's eyes. And these as well as all cases of the nature of instinct are facts similar to the distinctive angles of crystals, and the distinctive numbers of stamens and pistils in plants; instances of the use of Number in the framing of nature, from which no one would infer any relationship of a fatherly character between the Maker of these things and his works. No one of these creatures, it may be safely averred, can either discern the presence of Number in things all around it, or use the powers of Number in doing its own work. The sagacious elephant is no astronomer; the clever monkey is no chemist. No bird can account by Number for its own sweet notes, nor help itself with an inch measure in building its nest, nor with an almanack in achieving its periodical migrations.

On the other hand it may be objected to the main argument, that all men have not in their minds the same readiness in comprehending Number, and computing it. And in fact it has been above admitted, that many readers may probably find it hard to carry out in thought the application of Kepler's third great law. But this is no more than saying, that human beings have different measures of mental capacity, and different degrees and kinds of mental training. Certain it is, that men of all races can be taught with ease such sums as that

two and two make four, or that twice three must needs make six. Amongst ourselves men of average intelligence, well educated, are usually acquainted with such a modicum both of arithmetic and of modern Science in general, as would enable them to follow the illustrations of this argument. Even in our elementary schools, boys at an early age learn with ease to apply general rules of Number to particular cases. Nor are the elder pupils in some of these schools wholly unacquainted with the numerical laws of gravitation, of planetary motion, and of chemical combination. When these laws are more widely studied they will be more generally understood. And this is equivalent to admitting, that the minds of men in general have a capacity for entertaining precisely those ideas of Number, on which the fabric of modern Science has been built up, by the most highly gifted members of the race.

§ 11.—*A Divine Intelligence discerned in the world
by man.*

Those who trace the parentage of the human race through the brute creation may serve us for an authority in urging likeness of lineament as indicating descent by lineage. And it cannot be denied that there is, as they allege, in the frame and functions of man's body a very notable resemblance to those of animals in general. But this

cannot justify us in ignoring that portion of ourselves, if there be any, which we feel to be supreme over the rest, and of which we find no like consciousness in other creatures. To limit our knowledge by the range of our outward senses is to forget, that even if it were true that eyes and ears do really see and hear, and not merely serve us in our seeing and hearing, yet certainly these our organs cannot reason on the phenomena thus observed, cannot estimate and compare amounts of weight and measure, and could never by processes of calculation have disclosed the long hidden numerical mysteries of stellar space and of molecular minutiae. In these achievements of his spiritual faculties, whatsoever these may be, man stands alone amongst the living creatures all around him. He studies their respective natures, and the phenomena of the heavens, with the same discriminating insight. No one of them attempts to study his in like manner. The notion of man being their offspring seems as far from reasonable as that of their being the progeny of man. And according to the strict Logic of Probability, quite as cogent in its way as any other, he who, after weighing what can be said on both sides, should hold, that the world made itself, or that once upon a time a brood of apes became men and women, would be rated as about equal in understanding to a modern thinker, if such an one there be, who in sceptical defiance of scientific

verities should maintain that the earth is not a globe but a flat surface.

Unless then it can be proved, that man is himself the mighty Founder of the earth and of the heavens, we are constrained to refer their origin, and his also, to a Force or Power, instinct with Intelligence, and under the direction of a sovereign Will ; a Force invisible to sense, but such as the spirit within every man is capable of discerning. Of the existence and action of this Force we have an indication in the Arbitrary Constants, which occur in many problems of Astronomy, as well as in other sciences ; signifying weights, measures, or proportions, invariably determined ; limitations which seem to proceed from an arbitrium or Will, having power to enforce its edicts, when it speaks the word, Hitherto shalt thou go, and no further. The distances of each planetary orbit from the sun, as approximately stated in Bode's law, the degrees of temperature at which water freezes and boils under ordinary circumstances, and the nature and proportion of the elements in the blood of animals, are constants of a kind which in this sense may be well termed arbitrary, as having been ordered by a supreme Will, for reasons beyond the scrutiny of man. Moreover, the height and bulk assigned to different organic beings as well as other elements of their form and structure, appear to be constants of this nature, within certain limits. And

when we are asked to conceive it possible, that quadrupeds, by dint of exertion and self-adaptation to circumstances, might in the course of long ages become bipeds, a sound philosophy would agree with experience and religion in replying, that on the contrary even man, however superior in intelligence he may be, cannot by any means so much as add one cubit to his stature. If therefore without prejudice we consult our own minds, and compare what we think within us with what we see around us, our reason leads us to adopt, as the true solution of the problem proposed, the opening statement of the earliest written record in existence, 'In the beginning God created the heavens and the earth.' And if we had no other evidence besides the idea of Number, shewing the harmony between that Supreme Intelligence and our own limited faculties, a sound philosophy might bring us no less readily to the conclusion, expressed by words which occur soon afterwards in the same ancient record: 'God created man in his own image.'

§ 12.—*Human intelligence linked by Number with that which is Divine.*

By introducing the above quotations it is by no means intended to assume the authority of inspiration, in arguing with those who doubt as to the words being inspired. Nor indeed would the question of a Divine Personality have been

approached, had it not been indispensable to plead reasons for admitting the existence of a personal Divine Intelligence, as a preliminary to reasoning upon there being any link connecting it with the personal human mind. The elevating consciousness of such a connexion seems to have been present to the mind of Kepler, when in reference to his numerical discoveries he gloried in the conviction, that he had been privileged 'to think the thoughts of God.' We have modern philosophers, not destitute of a share of his sagacity, and fully able to appreciate his great genius, who plume themselves on having devised probabilities, however vague, for ascribing to man a lineage which would qualify him for thinking the thoughts of a gorilla. Is it Science to hold for truth such an undemonstrated hypothesis as this? Is it philosophical, not to say humane, on the strength of observations however laborious, and of speculations however ingenious, to shake recklessly the faith of the unstable, to publish far and wide, as results of scientific research confessedly far from demonstrated, notions subversive of the conviction underlying all religious faith, namely, that there is something in common between the worshipper and the object of worship, enabling the one to hold communion with the other?

To establish the important proposition, that in the faculty of Number one such link is to be found, one which warrants man in laying claim to a lineage

not below but above humanity, has been the main object of this argument; which might easily be pursued much further. That there are other and stronger and closer ties of relationship, which man's reason could not in like manner have discovered, is the conviction of every believer in revelation. But for those who are strangers to the bonds of divine love, as manifested in the redemption of our race, that most signal pledge of fatherly relationship between God and man, it may be useful to point out this far-reaching indication of their intellectual pedigree, to insist on the many striking proofs of their having inherited by birthright this particle of an intelligence superhuman, in which the lower orders of creation have no share. Let them consider then how true it is, that according to the uniform experience of long ages parents produce offspring after their kind in all their generations. Let them note that there is no valid induction to the contrary forthcoming. And let them hear the voice of Number, if they will listen to no other, telling them : Ye are scions of a heaven-born race; and though every atom of your bodies be of the earth, earthy, yet is there that within you which is after the likeness of the Father of your spirits, an inborn gift derived from Him, given to your family, and to yours only, of all his creatures here below, a trait of family resemblance ineffaceable, however far you may have fallen from your first high estate, and still answer-

ing, however faintly in most of you, and imperfectly in all, to the same faculty in Himself, even as an impression corresponds, in a material ever so inferior, with the seal impressing it.

To those who are acquainted with a more excellent way, the considerations involved in this argument may suggest matter for profitable meditation ; tending as they do to make evident the existence and the unity of God, and man's likeness to the Most High as of a child to a parent. The devout reader of Holy Scripture will remember the questions bearing on our subject, by which the prophet would confirm the faith of the faint-hearted : ' Who hath measured the waters in the hollow of his hand ? and meted out the heaven with the span ? and comprehended the dust of the earth in a measure ? and weighed the mountains in scales, and the hills in a balance ? ' In the same passage we are exhorted : ' Lift up your eyes on high, and behold who hath created these things, that bringeth out their host by number : He calleth them all by their names, by the greatness of his might, for that he is strong in power ; not one faileth.' Throughout the Bible we have many similar encouragements to study the attributes of the Almighty in his works. And if in pursuing that study we find that we meet continually with instances of a harmony between our own thoughts and the wisdom by which the worlds were made, we cannot fail to grow in that consciousness of relation-

ship which leads us at once to reverence our Maker and to respect ourselves ; which renders us more firm in our religious convictions, and at the same time more fervent in our religious affections. But the intellectual and the emotional portions of man's nature are not separable except in thought. Man is one altogether, completely one ; however many-sided in his individuality. A religion whereof the truth is not rooted in the mind, and a religion whereof the motives have no influence on the heart, are neither the one nor the other any true human religion at all. Nevertheless, the heart may be reached through the mind, as undoubtedly the conclusions of the mind are often influenced by the inclinations of the heart. And since religion, in all its stages, proceeds on the recognition of some fellowship on the part of man with a God invisible but not unknowable, this argument may help to further its salutary influence, both on those who doubt, and on those who believe, if it succeed in impressing on its readers the important position manifestly occupied by Number, as a Link between the human and the Divine Intelligence.

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